Mathematics > Differential Geometry

Geometry of Darboux-Manakov-Zakharov systems and its application

Peter J. Vassiliou

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The intrinsic geometric properties of generalized Darboux-Manakov-Zakharov systems of semilinear partial differential equations \label{GDMZabstract} \frac{\partial^2 u}{\partial x_i\partial x_j}=f_{ij}\Big(x_k,u,\frac{\partial u}{\partial x_l}\Big), 1\leq i<j\leq n, k,l\in\{1,...,n\} for a real-valued function $u(x_1,...,x_n)$ are studied with particular reference to the linear systems in this equation class.
System (\ref{GDMZabstract}) will not generally be involutive in the sense of Cartan: its coefficients will be constrained by complicated nonlinear integrability conditions. We derive geometric tools for explicitly constructing involutive systems of the form (\ref{GDMZabstract}), essentially solving the integrability conditions. Specializing to the linear case provides us with a novel way of viewing and solving the multi-dimensional n-wave resonant interaction system and its modified version as well as constructing new examples of semi-Hamiltonian systems of hydrodynamic type. The general theory is illustrated by a study of these applications.

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